## Section 11. Oysters

### Introduction

The native oyster, *Crassostrea virginica*, is currently estimated at less than 1% of its historic abundance. The decline in its abundance can be attributed to many factors, including fishing, habitat destruction, disease mortality, reduced water quality and the interactions among these factors. The role of degraded water quality and its impact on the oyster resource has a dual nature. Oysters are negatively impacted by sedimentation, turbidity and anoxic conditions, thereby limiting oyster restoration. Oysters also have the potential to improve water clarity and remove algae from the water through their suspension-feeding activities; thereby having a positive effect on water quality. However, at current low abundance their positive effects are minimal.

### Chesapeake Bay FMP

Fishery managers in the Chesapeake Bay have been addressing oyster issues through fishery management plans. A *Chesapeake Bay Oyster Management Plan* was adopted in 1989 and revised in 1994. Oyster restoration efforts were addressed in the *Chesapeake Bay Aquatic Reef Habitat Plan*, also completed in 1994. A new Oyster Management Plan (OMP) was adopted in December 2004. The OMP combines the past efforts of fishery and habitat management in one document and includes additional considerations. Maryland and Virginia have also developed statewide plans. The Maryland Action Plan was adopted in 1993 and reflects a collaborative approach to management. Similarly, the Virginia Restoration Plan coordinates restoration, monitoring efforts and the management of private and public grounds. The state plans provide the specific measures for implementing the *OMP* strategies and actions. In addition, a separate but coordinated effort addresses the issue of poor water quality in the Bay. Water quality criteria, such as levels of dissolved oxygen (DO), chlorophyll *a*, nitrogen and phosphorous, have been set to delist the Bay as an impaired body of water. The Chesapeake Bay Program has led the effort to determine water quality criteria, and the states are working to develop tributary strategies to meet the criteria in all of the Bay's tributaries. Improved water quality is a critical factor in supporting a vibrant oyster resource**.**

The 2004 *OMP* provides both a general framework and specific guidance for implementing a strategic, coordinated, multipartner management effort for oysters in the Bay. Representatives from state and federal agencies, academia, environmental groups and the oyster industry developed the plan. Part of the renewed effort to rebuild the Bay's native oyster resource came from a keystone commitment in the *Chesapeake 2000* agreement. The *OMP* defines several strategies for rebuilding and managing native oyster populations. They are: evaluating the use of sanctuaries and harvest reserves to obtain optimum ecological and economic benefits; rebuilding habitat; managing harvest; increasing hatchery production; evaluating the impediments to aquaculture; improving coordination among the oyster partners; and developing a baywide database to track restoration projects. The *OMP* endeavors to improve and complement the ongoing efforts of multiple oyster partners toward restoration in the Chesapeake Bay. Currently, the major impediments to rebuilding the oyster resource are the

impact of diseases and the degraded condition of oyster habitat. The magnitude of these impediments cannot be over-emphasized.

An implementation table (Table 11.1) summarizes the plan and indicates which oyster partners will have the main responsibility for implementing the actions. The OMP also provides guidance on implementing oyster restoration projects including plan content, monitoring, review and evaluation. This guidance applies to all restoration projects. It includes site selection and site suitability criteria. Since there is a new effort to develop ecosystem-based FMPs, a decision was made to rework the biological background, using the EBFMP approach. Any ecosystem-based management strategies developed as part of the Oyster EBFMP will be considered as an amendment, similar to the way the EIS results will be handled. A complete copy of the 2004 OMP can be found on the Chesapeake Bay Program website *www.chesapeakebay.net* .

**Alternative Approaches to Oyster Restoration**

A programmatic Environmental Impact Statement (EIS) is in progress to evaluate alternative approaches to increasing oysters in the Chesapeake Bay. The action to be evaluated is a proposal to introduce a non-native oyster, C. ariakensis. Alternatives to the introduction will also be considered and include taking no action and continuing the current management policies; expanding the native oyster restoration program; implementing a harvest moratorium; establishing and/or expanding aquaculture operations for either the native or non-native species; and introducing and propagating an alternative oyster species. Upon completion of the EIS, the OMP will be reviewed to determine whether any management actions need to be added or amended.

A number of research projects are underway to assist in the preparation of an Environmental Impact Statement (EIS) on Oyster Restoration alternatives. These projects include: an Ecological Risk Assessment to evaluate alternative approaches to increasing oyster populations in Chesapeake Bay; an economic component of the EIS; additional research and development studies on *C. ariakensis*; an oyster larval dispersal model; reproductive studies and evaluation of gametogenesis and spawning; and disease susceptibility. A workshop on the demographic modeling of oyster populations was held in July 2004. The workshop participants discussed the known and unknown aspects of oyster life history and the appropriate values for the parameterization of the oyster demographic model. The goal of the modeling project is to predict the estimated baywide abundance/biomass of oysters and their distribution. The model results should provide a map of biomass distribution that will benefit the sanctuary program; and, examine the probabilities of achieving specific biomass levels. The results of a number of research projects should be available in 2005-2006.

Several workshops have been sponsored to support a number of different efforts that are underway for oysters. The NOAA Chesapeake Bay office hosted a workshop to focus on the data management of oyster restoration and monitoring activities. The objective of the workshop was to bring together the various oyster partners and begin to develop a comprehensive oyster restoration database. The workshop supported the strategies and actions in the OMP regarding the development of a Technical workgroup and a central database. As a result of the workshop, oyster data sources were identified, members for a technical committee were identified, and pathways for coordinating a baywide database were discussed.

## Stock Status

The oyster stock in the Chesapeake Bay is currently estimated at less than 1% of its historic abundance. A collaborative project was initiated between researchers in Maryland and Virginia to quantify a baseline oyster population in the Bay, standardize population monitoring efforts, and measure progress towards the objective of increasing oyster biomass (Mann et al. 2003). Estimating the oyster population in terms of biomass rather than abundance (absolute number) eliminates misleading results due to the large and variable number of spat. Using oyster biomass is a more useful barometer of population size and ecological function (Mann et al. 2003).

Oyster biomass data are obtained from designated sentinel sites in Maryland and Virginia. The term "sentinel site" describes a monitoring station that has a long-term monitoring data set. Mean oyster densities are estimated from these sites and then extrapolated over an estimated habitat area. In terms of biomass, it is assumed that the dry tissue weight of an average oyster is 1 g and includes all oysters 76 mm and larger or oysters that are approximately one year and older. The most critical issue for estimating the baywide abundance of oysters is to accurately assess the productive bottom areas and areas of marginal production (Mann et al. 2003). The total biomass estimate relies heavily on estimates of oyster habitat and an incorrect estimate of habitat can result in an over or under-estimation of oyster population size. The most recent Maryland oyster biomass estimate is approximately $1.84 \times 10^8$ g/dry weight or $2.05 \times 10^8$ individual oysters. For a more detailed explanation of the oyster biomass estimates for Maryland and Virginia, please visit the website at *www.vims.edu/mollusc/cbope*.

New techniques for surveying the bottom suggest that as little as 1-2% of Maryland's historic oyster grounds can be classified as clean or lightly covered with sediment (Smith, unpublished data). Sediment-free shell is one of the most important components of quality oyster habitat (MacKenzie 1983; Smith 2001). Based on Virginia's Restoration Plan, there are approximately 11,500 acres of potentially restorable oyster habitat in the Virginia portion of the Chesapeake Bay. Based on limited data, the best estimate of potentially restorable habitat in Maryland is 10-20,000 acres.

A stock assessment for oysters in Chesapeake Bay is not available but one is needed. A formal stock assessment would provide biological reference points for managing the oyster resource. A new bay bottom survey is also needed to determine available oyster habitat.

## Fishery Statistics

The main strategy for regulating harvest and enhancing harvest potential is to establish sanctuaries and special management areas throughout the Bay. By establishing areas that are protected from harvest, fishing mortality rates (F) in managed areas and the overall F for the population will decrease. Currently, the methods for regulating harvest include controlling the size and amount of oysters harvested through daily bushel limits, size restrictions, gear restrictions, time limits, seasons, limited entry and area closures.

Beginning in the late 1980s, disease became a major cause of size selective mortality in adult oysters. Consequently, harvest pressure has decreased with fewer watermen reporting landings and fewer harvest days (Table 11.2). The increase from 26,000 bushels in 2003/2004 to 58,000 bushels in 2004/2005 is not a sign of recovery of the stocks. Although 58,000 bushels is over double last year's harvest, it is still very low with respect to previous years. Also, the harvest is limited in scope and is mostly from three small zones. In past years, many areas were in production and yielded significant harvests both individually and collectively. The few zones that produced the harvest had good survival due to a decrease in disease mortality (C,Judy, MDNR pers.comm).

Under current disease conditions, the impacts of adjusting F on stock size need to be better understood. A major challenge is to determine if a reduction in F will allow the oyster population to rebuild to a more productive level, and, at the same time, determine what level of exploitation is appropriate and will not compromise restoration efforts.

**Emerging Issues**

Alternative strategies are under consideration for restoring oysters in the Chesapeake Bay. The results of the EIS will have a major impact on how oysters are managed in the future. In the mean time, an oyster stock assessment and a new bay bottom survey are needed to determine a better estimate of abundance and habitat quality. Once a stock assessment is completed appropriate biological reference points could be determined.

**References**

MacKenzie, Clyde L., Jr. 1970. Causes of oyster spat mortality, conditions of oyster setting beds, and recommendations for oyster bed management. Proc. Natl. Shellfish. Assoc. 60:59-67.

Mann, R., S.Jordan, G.Smith, K. Paynter, J. Wesson, M.Christman, J. Vanisko, J. Harding, K. Greenhawk, and M. Southworth. 2003. Oyster population estimation in support of the ten-year goal for oyster restoration in the Chesapeake Bay: Developing strategies for restoring and managing the Eastern oyster. Chesapeake Bay Fisheries Research Program Symposium Report. NOAA.

Smith, G. F. 2001. Cooperative Oxford Laboratory—Mapping and Analysis Project Activities Report: Initiatives toward oyster restoration. Oxford, MD

Table 11.1 Chesapeake Bay Program Oyster Management Plan Implementation (updated 8/05)

| Section | Action | Date | Comments |
|---|---|---|---|
| Disease Strategy 3.1A. Utilize disease management in all aspects of restoration & harvest to minimize spreading disease 3.1B. Develop & implement disease strategies within each of the 3 designated salinity zones. | 3.1 Conduct an analysis of how disease management might affect overall survival and productivity. Answer the following question: What management strategies will help increase biomass over a large scale and in the long-term? | 2005 | Part of this question will be addressed via the EIS research projects and modeling efforts. Partners involved in the endeavor include. Univ. of MD, VIMS, MDNR, and VMRC. |
| | 3.2 Increase hatchery production to supplement natural recruitment and mitigate the prevalence of *P.marinus* (refer to Chapter VI Hatchery Production for additional details) | 2005 | Dependent on spawning success in the hatcheries and availability of cultch. Univ. of MD, VIMS, MDNR, aquaculture industry. Additional funds were provided in 2005 to increase production**.** |
| | 3.3 Establish broodstock sanctuaries in heavily infected areas to possibly produce disease resistant seed. (see Chapter IV Sanctuaries for more details). | 2006 | The larval transport model may suggest additional areas to designate as sanctuaries. MDNR, VMRC, ORP, VA Corps |
| | 3.4 Develop, implement and maintain a seed policy to reduce and minimize disease impacts. | 2004 | MDNR reviewed previous seed policy, developed a new one and is complying by the policy**..** |
| | 3.5 Implement oyster surveys as necessary to obtain the best estimates of oyster population data: a) Increase the frequency & spatial intensity of sampling; b) Seek additional funding. | On-going | MDNR, VIMS (Mann et al. 2003) |
| Sanctuaries Strategy 4.1 A network of clearly marked oyster sanctuaries will be established throughout the Chesapeake Bay and its tributaries<br><br>Strategy 4.2. Utilize the steps outlined in the OMP for establishing oyster sanctuaries throughout the bay. | 4.2.1 Decisions on where to locate sanctuaries will be guided by the Virginia Oyster Restoration Plan developed by VIMS and VMRC and Maryland's Priority Restoration Areas developed by MDNR and the Maryland Oyster Roundtable Steering Committee. The maps will be used as a preliminary tool to focus restoration activities | On-going | Virginia has completed their Restoration Plan and will use that as a guide for future projects contingent upon the amount of funding for a given project<br>MD has completed maps for 10 areas and will develop a process for identifying and focusing priorities for restoration. |
| | 4.2.2 Utilize existing protocols & standard operating procedures for recording or charting GPS coordinates for oyster sanctuaries in order to verify locations and track restoration progress. | Beginning in 2005 | Requirement for all oyster projects and oyster partners. State agencies have been using standard methods |
| | 4.2.3 Evaluate the use of alternative cultch material because all restoration efforts depend on the availability of suitable habitat and traditional shell dredging cannot support the scale of the current & future sanctuary initiative. | On-going | A study in MD was conducted in various salinities. Report on file with DNR. |

Table 11.1 Chesapeake Bay Program Oyster Management Plan Implementation (updated 8/05)

| Section | Action | Date | Comments |
|---|---|---|---|
| | 4.2.4 Develop and implement techniques to locate and recover buried shell or shell with layers of sedimentation using vacuuming, bar cleaning or other innovative methods. | 2005 | Habitat cleaning projects have been conducted the past few years in MD. Electronic survey methods to i.d. buried shells are being evaluated. |
| | 4.2.5 Increase hatchery production to support restoration needs. Current seed levels are too low to effectively stock sanctuaries (see Chapter VI Hatchery and Aquaculture). | 2005 | Univ. of MD, MDNR, VIMS |
| | 4.2.6 Monitor areas to evaluate oyster population status and measure progress towards the commitment to increase oyster biomass by 10-fold. | On-going | Utilize the 1994 value as the baseline for measuring the increase in biomass. Provide annual updates. MNDR, VIMS |
| Sanctuaries (cont'd) Strategy 4.3 Management actions within sanctuaries are primarily based on salinity zones and focus on three key factors: growth, reproduction and disease. The zonal approach to management provides general guidelines for selecting project objectives and anticipating project results in each area | Strategy 4.3.A: Zone 1 (5ppt to <12ppt) Increase biomass & enhance reef habitat. Enhance reef/ bottom habitat to increase oyster biomass and promote the development of living oyster reefs with broad size/age class structure that supports a diverse reef community<br><br>Action 4.3.A.1 Identify priority areas in Zone 1 that would have the most success at reaching the defined project objectives<br><br>Action 4.3.A.2 Rehabilitate and maintain oyster bottom habitat to provide planting substrate for seed oysters and optimal conditions for larval settlement<br><br>Action 4.3.A.3 Plant hatchery produced SPF seed, if necessary, over several years to establish an oyster population with a diverse age class structure | 2005 | All oyster partners. Efforts underway. |
| | Strategy 4.3.B: Zone 2 (12-14ppt) Transition Area: The boundaries of Zone 2 shift because of variations in rainfall and resulting salinity. Consequently, Zone 2 will exhibit fluctuations in spat settlement and disease mortality. Projects in this zone must utilize current environmental data during planning.<br><br>Action 4.3.B.1 Critically examine long-term environmental conditions and develop relevant project objectives for sanctuaries in Zone 2.<br><br>Action 4.3.B.2 In the areas that have predominantly Zone 1 characteristics, utilize Zone 1 guidelines and in areas that have predominantly Zone 3 characteristics, utilize Zone 3 guidelines | | |

Table 11.1 Chesapeake Bay Program Oyster Management Plan Implementation (updated 8/05)

| Section | Action | Date | Comments |
|---|---|---|---|
| | Strategy 4.3.C (>14ppt) Develop Disease Tolerance:<br>It is not certain that disease resistance can develop via a management approach in Zone 3. The strategy will be to promote the development of disease resistance where disease mortality is high<br>Action 4.3.C.1 Reestablish and maintain bottom habitat for oyster spat settlement and growth of disease resistant adults<br>Action 4.3.C.2 Monitor Zone 3 sanctuaries to determine the effects of disease mortality<br>Action 4.3.C.3 Utilize Zone 3 as an area to test laboratory strains of disease resistant oysters<br>Action 4.3.C.4 Limit the use of natural seed to sanctuaries in Zone 3. The use of natural seed in repletion areas is allowed as long as disease protocols are followed. | | |
| Sanctuaries (cont'd)<br><br>Strategy 4.4<br>The jurisdictions will establish oyster sanctuaries to promote maximum ecological value | Action 4.4.1 Identify areas of special interest throughout the Bay, especially areas that may retain larvae (maybe auto-recruiting), and protect them using the sanctuary status | To be determined | Areas may be identified using the larval transport model. |
| Strategy 4.5<br>Implement the actions described in chapter III to address disease problems. In addition, the jurisdictions will take further action to minimize the spread of disease | Action 4.5.1 Utilize only SPF hatchery seed in sanctuaries designated for oyster biomass accumulation, Zone 1 and Zone 2. | On-going | All oyster partners |
| | Action 4.5.2 Place hatchery seed on newly created sanctuary bottom and not on top of infected oyster populations in order to prevent rapid infection of the disease-free seed | | |
| | Action 4.5.3 Continue to prohibit the movement of infected oysters from higher salinity waters onto newly or previously created sanctuaries in Zone 1 | On-going | All oyster partners. |
| Sanctuaries (cont'd)<br>Strategy 4.6 To facilitate the enforcement of closed areas, especially sanctuaries, implement the following actions: | Action 4.6.1 Sanctuaries will be placed in geographically distinct areas with enough space to create a buffer zone between harvest and sanctuary areas to enable enforcement | Began in 2003 and continue | |
| | Action 4.6.2 Sanctuaries will be buoyed and marked | | |
| | Action 4.6.3 The public and judiciary will be notified about sanctuary areas through educational initiatives, public announcements and stakeholder meetings | | State agencies are responsible for marking sanctuary areas. |
| | Action 4.6.4 New enforcement measures will be identified and implemented. Additional manpower will be recommended if necessary | | |

Table 11.1 Chesapeake Bay Program Oyster Management Plan Implementation (updated 8/05)

| Section | Action | Date | Comments |
|---|---|---|---|
| Managing Harvest Strategy 5.1 Establish sanctuaries & special management areas thereby reducing F & develop appropriate biological reference pts. | Action 5.1.1 Establish a network of sanctuaries (refer to Section 1.IV for details) and special management areas throughout the Bay to limit harvest and increase oyster production | Continue | Sanctuaries have already been designated in both MD and VA. Continue to create new sanctuaries as appropriate based on the best scientific data. Thirty-one sanctuaries exist in MD plus designated Reserves**.** |
| | Action 5.1.2 Define appropriate biological reference points for the oyster resource based on the results of the bay wide stock assessment | 2006 | The EIS modeling efforts and research projects will provide input to the Oyster Scientific and Technical Advisory Committee who will be responsible for defining BRPs. |
| | Action 5.1.3 Utilize the disease guidelines and actions presented in Section 1.III in all aspects of special management areas and the fishery | 2005 | All oyster partners are responsible for implementing the strategies & actions. |
| | Action 5.1.4 Control oyster harvest to reach an appropriate F determined by the Oyster Scientific Committee. | To be determined | Oyster harvest is already controlled through a number of regulations by MDNR & VMRC. When BRPs are determined, a target and threshold F will be defined. |
| Strategy 5.2. Develop guidelines for managing fishing effort and monitoring oysters in open and closed areas. | Action 5.2.1 a) Determine the criteria for opening and closing areas; b) Monitor population; c) Determine level of acceptable exploitation; d) Regulate harvest and gear type; e) Develop additional monitoring if necessary; f) Close area when harvest criteria are met. | 2005 | MDNR & VMRC will be responsible for implementing the regulations for opening and closing special management areas. |
| | Action 5.2.2 Utilize the site selection criteria set forth in the OMP to select special management areas (see Section 2 for details). | 2005 | All oyster partners. |
| | Action 5.2.3 a) MDNR will utilize the ORT STAC to review & make recommendations on where to locate harvest reserve areas; b) VA will utilize their current system to review and make recommendations on open & closed areas. | Continue | MDNR, MWA, and ORP will be responsible for implementing the recommendations of the ORT STAC. |
| | Action 5.2.4 Identify and implement regulatory & legislative changes needed for managing open & closed harvest areas. | To be determined | MDNR, VMRC |
| | Action 5.2.5 a) Evaluate how rotating open & closed areas contributes to reproduction, oyster biomass & harvest; b) Based on the harvest reserve biological data, reevaluate the criteria (Action 5.2.1) for opening & closing areas & modify actions as necessary. | 2005 | Detailed harvest and cost data exists after the first open season for reserve area (2005). Additional monitoring needed in 2006. This monitoring will need funding.. |

Table 11.1 Chesapeake Bay Program Oyster Management Plan Implementation (updated 8/05)

| Section | Action | Date | Comments |
|---|---|---|---|
| Strategy 5.3 a) Follow project guidance criteria specified in section 2 when developing repletion program work plans; b) Maintain the MDNR work plan review process | Action 5.3.1 Modify the MD repletion program through the established ORT Steering & Scientific Committees to reduce and minimize disease impacts: a) Establish criteria to limit and/or restrict seed movement to certain regions depending on environmental conditions & disease levels; b) Avoid transplanting older year classes that have higher levels of disease than young spat; c) Rotate and/or clean seed areas; d) Allow old seed areas to lie fallow and/or be harvested; e) Utilize the disease results from the Fall survey; f) Transplant wild seed as soon as possible. | 2004 | MDNR is implementing these measures. |
| | Action 5.3.2 MD will evaluate the effects of the repletion program on oyster population dynamics and habitat; and document how it contributes to an increase in oyster biomass & habitat. | 2006 | The EIS will evaluate certain aspects of the repletion program. |
| Strategy 5.4 Strengthen the enforcement of oyster closures in sanctuaries & special management areas. | Action 5.4.1 Evaluate and implement the appropriate enforcement measures. | 2005 | MNDR, VMRC |
| | Action 5.4.2 Prohibit the culling of oysters while underway to minimize the movement of infected oysters. | On-going | MDNR, VMRC |
| Hatchery and Aquaculture Considerations Strategy 6.1 Utilize hatchery-produced seed to augment natural reproduction, reduce disease effects & increase biomass. | Action 6.1.1 Develop an interlab certification program for oyster diseases. Utilize the molecular diagnostic protocols for certifying SPF oyster seed developed by the VIMS Shellfish Pathology Laboratory. | 2005 | VIMS, Univ. of MD, MDNR |
| | Action 6.1.2 MD will increase hatchery production of SPF seed to support the 10-fold increase in oyster biomass: a) Increase & maintain as necessary the operating funds for each MD hatchery facility; b) Evaluate & optimize the efficiency of each facility in order to ensure maximum production of spat. | On- going | MDNR, ORP, Univ. of MD |
| | Action 6.1.3 Continue the protocol for certifying and using SPF seed: a) establish standards & refine criteria; b) use only SPF seed in sanctuaries located in Zone 1 (< 12ppt). | Continue | VIMS, MDNR, Univ. of MD |

Table 11.1 Chesapeake Bay Program Oyster Management Plan Implementation (updated 8/05)

| Section | Action | Date | Comments |
|---|---|---|---|
| | Action 6.1.4 The U.S. Army Corps of Engineers (COE) will conduct an analysis of hatchery project production in relationship to environmental benefits as part of its long-term restoration planning, and determine whether augmenting or building new hatchery (ies) is warranted | 2005 | ACOE |
| Hatchery and Aquaculture Considerations (cont'd) | Action 6.1.5 Virginia will increase hatchery production of disease resistant seed to support the 10-fold increase in oyster production: a) Increase and maintain as necessary, the operating funds for oyster breeding in Virginia; b)Evaluate the feasibility of a public or a public-private hatchery | On going | VMRC, VIMS |
| | Action 6.1.6 Virginia will develop strategies for effective seeding of reefs and their effects on recruitment, especially in relation to the spread of disease resistance in the wild population. | 2005 | VMRC, VIMS |
| Strategy 6.2 Continue to track the genetic background of broodstocks used in hatcheries for restoration or replenishment activities | No specific actions recommended at this time. | To be determined | MDNR, VMRC |
| Strategy 6.3 Develop recommendations for using disease resistant strains of native oysters for restoration. Selectively bred oyster strains should be used for restoration only in areas where native oysters are locally depleted. | Action 6.3.1 Assess and evaluate the use of disease resistant stocks as a tool for increasing disease resistance in the native oyster population in the Bay. | 2005/2006 | Oyster Scientific and Technical Committee<br>UnMD |
| | Action 6.3.2 Monitor restoration activities to clarify the interaction between selectively bred strains and wild stocks of oysters. | 2005 | UnMD, ORP, VMRC |

Table 11.1 Chesapeake Bay Program Oyster Management Plan Implementation (updated 8/05)

| Section | Action | Date | Comments |
|---|---|---|---|
| Strategy 6.4 The members of the OMP drafting team will review the MD task force report & recommend changes to the OMP as appropriate regarding aquaculture strategies & actions | Action 6.4.1 Amend the OMP as necessary to incorporate new strategies and actions regarding aquaculture. | To be determined | Dependent on the results of the Aquaculture Task Force. |
| Monitoring and Information Management Strategy 7.1 A) Utilize the results of the oyster stock assessment as an estimate of oyster abundance in the Bay; B) Use the 1994 biomass value as a baseline to track progress towards the 10-fold objective. | Action 7.1.1 Conduct monitoring programs that are consistent in terms of sampling procedure, timing of sampling, types of data collected, and analysis and provide the results to a central database or databases. | Continue | All oyster partners |
| | Action 7.1.2 Establish a Technical Committee to develop data management guidelines for handling oyster data. | 2005 | NOAA |
| | Action 7.1.3 Develop and maintain a database to track oyster restoration projects and provide web-based access. | 2005 | MDNR, VMRC, NOAA |
| | Action 7.1.4 The Chesapeake Bay Program will conduct an annual oyster symposium | | CBP |
| | Action 7.1.5 Promote the research recommendations listed in Section 2. | 2005 | All oyster partners. |

## Table 11.2 Maryland Oyster Harvest Summary

| | | |
|---|---|---|
| Average for 1970-1986 | 2.2 million bu. per year | Time span prior to significant disease mortality which began in summer 1987. |
| Average for 1987-2003 | ~270,000 bu. per year | Time span showing the impact of disease mortality. |
| Harvest for 2003 | 55,840 bushels this year | Result of 4 year drought (1999-02). New record low harvest. |
| Harvest for 2004 | 26,495 bushels this year | Continued impact of the 4 year drought. Another new record low harvest. |

| Season | Harvest in Bushels | Dockside Value | Bushels/Man/Day | Comments |
|---|---|---|---|---|
| 1974-75 | 2,559,112 | $ 11,667,380 | 16.1 | |
| 1975-76 | 2,449,440 | $ 14,660,716 | 15.5 | |
| 1976-77 | 1,891,614 | $ 13,920,972 | 12.1 | |
| 1977-78 | 2,311,434 | $ 15,468,704 | 14.7 | |
| 1978-79 | 2,197,457 | $ 14,818,941 | 14.7 | |
| 1979-80 | 2,111,080 | $ 17,665,698 | 13.7 | |
| 1980-81 | 2,532,321 | $ 20,163,147 | 14.3 | |
| 1981-82 | 2,308,619 | $ 20,484,309 | 13.1 | |
| 1982-83 | 1,481,942 | $ 14,535,936 | 9.4 | ----Disease mortality in the early 80s was |
| 1983-84 | 1,076,884 | $ 14,579,122 | 8.1 | the major cause of this 1 million bushel |
| 1984-85 | 1,142,493 | $ 16,869,501 | 7.8 | decline since 1980. |
| 1985-86 | 1,557,091 | $ 16,653,862 | 9.8 | |
| 1986-87 | 976,162 | $ 16,516,182 | 6.7 | |
| 1987-88 | 363,259 | $ 7,341,501 | 5.2 | ----Prior to the start of this season, in the |
| 1988-89 | 398,509 | $ 7,443,487 | 5.5 | summer of 1987, disease caused a |
| 1989-90 | 414,445 | $ 9,910,448 | 5.2 | widespread die-off of market oysters. |
| 1990-91 | 418,393 | $ 9,451,855 | 5.2 | Note the decline in harvest for |
| 1991-92 | 323,189 | $ 6,449,539 | 5.3 | this time period as disease |
| 1992-93 | 123,618 | $ 2,686,777 | 4.6 | continued its grip. |
| 1993-94 | 79,618 | $ 1,375,465 | 6.2 | -----All time low harvest, until 2003 |
| 1994-95 | 164,641 | $ 3,282,838 | 5.7 | |
| 1995-96 | 199,798 | $ 3,218,329 | 6.9 | ----Lower salinity and lower disease due to |
| 1996-97 | 177,600 | $ 3,769,923 | 5.8 | high rainfall in 1993, 1994, and 1996. |
| 1997-98 | 284,980 | $ 5,742,280 | 6.5 | -----Survival improved as disease mortality declined. Harvests increased. |
| 1998-99 | 423,219 | $ 7,829,111 | 5.8 | -----Survival continued. Peak harvest. |
| 1999-00 | 380,675 | $ 7,231,980 | 7.9 | -----Drought began. |
| 2000-01 | 347,968 | $ 6,864,247 | 8.3 | -----Drought continues. |
| 2001-02 | 148,155 | $ 2,923,560 | 6.8 | -----Drought continues: disease at high levels and widespread |
| 2002-03 | 55,840 | $ 1,621,748 | | -----Drought impacts severe. Record high disease levels |
| 2003-04 | 26,495 | $ 625,583 | | cause excessive mortality. Oyster population pummeled. |
| 2004-05 | 58,235 (April) | | | Harvest declines. Decline in mortality in 2003/04. |

Source: MdDNR, SHELLFISH PROGRAM APR 2005